

A NEW SPECIES OF LEAF-MINING *OULEMA* FROM PANAMA (COLEOPTERA: CHRYSOMELIDAE; CRIOCERINAE)

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Abstract.—A new species of leaf-miner, *Oulema pumila* (Chrysomelidae:Criocerinae), from central Panamá is described and illustrated. Host plant and life history data are given. One of the smallest species, it is only the second record of the leaf-mining habit and the first host record from the Piperaceae recorded for the subfamily. Leaf-mining appears to be derived in this instance and we offer some observations on its evolution.

In 1994, one of us (A.A.) reared three beetles from mines in the leaves of an unidentified cultivated species of *Peperomia* (Piperaceae) in Arraiján, Panamá Province, Panamá. The new beetle belongs to the genus *Oulema* Des Gozis (Coleoptera: Chrysomelidae) and is one of the smallest members of the shining leaf beetle subfamily Criocerinae. The Criocerinae are a cosmopolitan group of nearly 2000 species noted for their smooth, often colorful appearance, narrow, unmarginated pronotum and excrement-covered, folivorous larvae. Our report of leaf-mining larvae for this species is only the second one for the Criocerinae. Moreover, it is the first shining leaf beetle recorded from the Piperaceae.

Although there is no universal agreement as to whether *Oulema* is a genus in its own right, or merely a subgenus within *Lema* (see for example Mohr, 1985), our use of *Oulema* follows the concept of White (1993) and Monrós (1960). Members of the genus *Oulema* have the following distinguishing characteristics: antennal tubercles very close together or touching; angle of grooves separating vertex from the frons less than 90°; the vertex is often produced into tubercles; pronotal constriction weak, sub-medial to basal; antennae length longer than ½ the body length; elytra without color patterning; 9th stria frequently interrupted for 2–8 punctures; aedeagus with lateral lobes more or less parallel and not concealing the medial lobe.

Measurements were made with an ocular micrometer. Dimensions were taken from prominent morphological features: elytral length from humerus to apex, and total length from vertex to elytral apex along the meson because the head is directed downward. The habitus drawing was made using india ink, chalk, negro and charcoal pencils on Coquille board.

Oulema pumila, new species

Fig. 1

Diagnosis: Head and pronotum narrower than the elytra, claws connate. Extremely small size of 2.6 to 2.9 mm total length. The head, pronotum and abdomen are

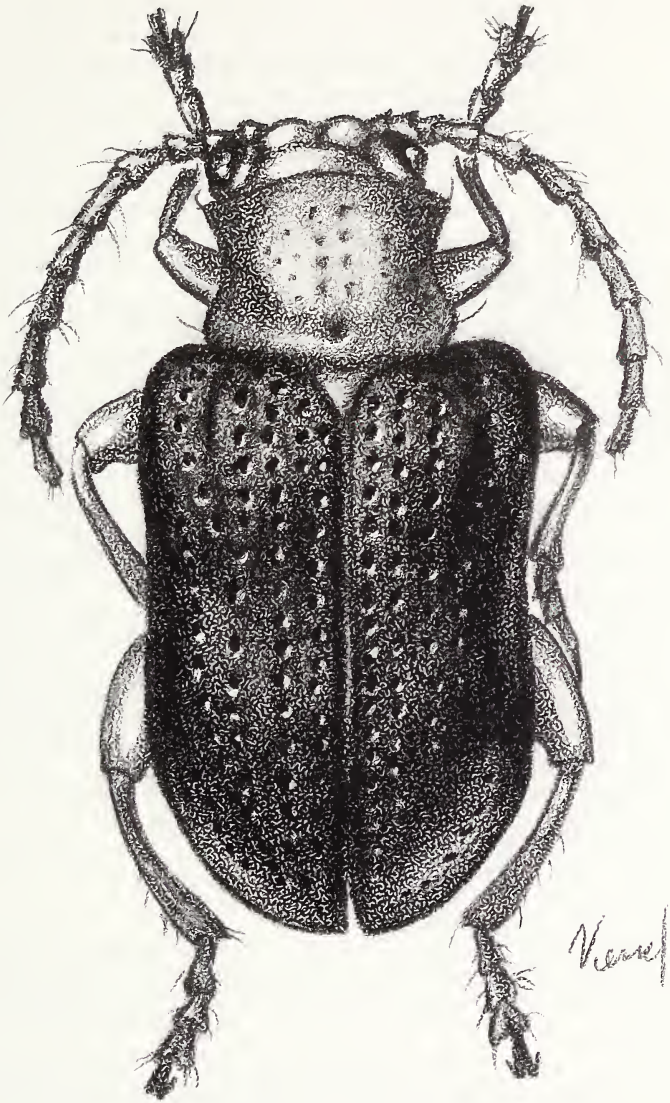


Fig. 1. *Oulema pumila*, dorsal habitus, holotype female.

yellowish orange. The head, is distinctly bituberculate at the vertex. The elytra are black with an iridescent violet tint.

Description: Form sub-cylindrical. Total length 2.6 to 2.9 mm including the tubercles of the vertex. *Head:* yellowish orange, shiny, much narrower than the anterior width of the pronotum. Clypeus, labrum and mouth parts brownish black. Frons separated from the vertex by deep grooves that form an "X" with the angle between them less than 90°, the antennal tubercles almost touching and much closer together than the frons-vertex junction. Vertex deeply divided by a broad, longitudinal groove and produced laterally into two elliptical tubercles. Antennae dark brown, longer than ½ the length of the body, eleven segmented, filiform but widening very gradually toward the apex. Eyes very weakly notched by less than ¼ their width; head moderately constricted behind the eyes. *Pronotum:* Pale orange with a yellowish cast, shiny and emarginate; slightly wider than long; the apex slightly wider than the basal width. A shallow transverse constriction, 94% of the apical width, divides the pronotum sub-medially at its basal ⅓ and bears a large medial pit. Disc with two longitudinal, medial rows of 5–6 medium-sized pits. *Elytra:* Violet-black and shiny with an iridescent reflection; a transverse depression at the basal ⅓; punctuation of the 10 striae medium in size and widely spaced but well aligned; the 9th stria incomplete for 4–5 punctures; scutellum orange. *Ventral side:* Pale orange with brownish melanism, shiny and covered with sparse setae; punctuation of mesosternum coarse, sparse and most dense near anterior edges; coxae pale yellowish orange. *Legs:* entirely light yellow with a brownish cast to the dorsal surfaces; two apical tarsal spurs; claws brownish-black, connate and simple.

Holotype. Female: PANAMA, Panama province, Arraiján, 24 Sept. 1994. A. Aiello. *Location:* United States National Museum.

Paratypes. 1 female and 1 male, same data as holotype. The female is deposited in the United States National Museum. The male is in the senior author's collection.

Variation. Paratype female 2.8 mm in length; paratype male 2.65 mm long with a brownish cast to ventral surfaces and the 9th stria interrupted for only 3 punctures.

Pupation. 10 Sept. 1994.

Eclosion. 24–25 Sept. 1994.

Pupation Chamber. White, foamy in texture, 3.5 mm long, 2.1 mm wide.

Host Plant. *Peperomia* sp. (Piperaceae).

Etymology. From the Latin meaning dwarfish.

Remarks: Although the aedeagus of the single male at our disposal was lost during dissection, it was observed to have had the sides of the lateral lobes parallel and not concealing the medial lobe, which conforms to the aedeagal characteristics for the genus *Oulema*.

Oulema pumila is most closely allied to Lacordair's (1845) second division that includes *Lema* species, *sensu lato*, that are distinguished by having red bodies and blue elytra with the 9th stria interrupted. Among the smallest species in the division, *Oulema pumila* can be differentiated from: *L. tenella*, by lacking a black abdomen; *L. jocosa* and *L. concinna* by lacking elytral markings of any kind; *L. vidua* and *L. impura* by lacking yellow elytra; *L. stolidia* by lacking an entirely black body; and from *L. gilveola* by having a notched eye.

Discussion: This tiny species is a rare denizen of Caribbean rain forest where it is a miner in the leaves of epiphytic pipers. This is the first host record for the Cri-

ocerinae from the Piperaceae. Examination of herbarium material revealed *Peperomia macrostachya* specimens with mines large enough to have been made by an insect the size of *O. pumila*. In addition, one pupal chamber in the leaf mesophyll was lined with a white, foamy substance typical of the buccal material produced by members of the subfamily Criocerinae to form pupation chambers.

Monrós (1960) mentions *Lema quadrivittata* de Borre as a leaf-miner of plants in the Commelinaceae of South America. *Oulema pumila* can be differentiated readily from *L. quadrivittata* by (1) the lack of elytral stripes, (2) size smaller than 4.2 mm and, (3) disparate host association.

The genus *Oulema* as proposed by Des Gozis (1886), embraces New and Old World Lemiini that fall into the red body/blue elytra category. This cosmopolitan genus of leaf beetles, recently augmented by White (1993), now includes 20 North American species, of which host plants are known for 15. It is interesting to note that the larvae of Old World species feed on the Poaceae while their New World cousins feed mainly on members of the dayflower family Commelinaceae. This may well indicate that a very old split in the genus occurred well before the appearance of the grasses, perhaps as a consequence of the break-up of Gondwana some 135 million years ago. The total number of species assigned to the genus undoubtedly will increase following much needed revision and reassignment of Central and South American species. The addition of *O. pumila* brings the number of Panamanian species in the subfamily Criocerinae to 34 (Vencl, *in prep.*).

Larvae of the entire subfamily Criocerinae are noteworthy for their peculiar habit of accumulating excrement on their backs to form fecal shields. Recently, fecal shields were demonstrated to contain predator deterrent chemicals derived entirely from host-plant metabolites (Morton and Vencl, 1998). When forced to feed on the surface, stem boring and probably leaf mining larvae form fecal shields (Richardson, 1893; Kaufmann, 1967; Vencl, pers. ob.). The retention of the shield-forming potential suggests that mining and boring are derived behaviors. Internal feeding modes obviate the need for a shield defense. When the proposed sister taxa to the Chrysomelidae, the Bruchidae and Cerambycidae, all with internally feeding larvae, are considered together with the numerous instances of gallicoly, stem, root and leaf-mining larvae within the Chrysomelidae itself, it becomes evident that surface folivory by leaf beetle larvae is a derived mode of feeding (Crowson, 1981). We suspect this to be the case because folivorous larvae, which are physically exposed, soft bodied and flightless, are more vulnerable to predators and parasitoids than are eggs, pupae or adults. These observations implicate natural enemies as major determiners of feeding behavior in leaf beetles in general and perhaps of leaf-mining in *O. pumila* in particular. Endophytism, which is uncommon in related criocerines, is a specific adaptation by *O. pumila* to the threat of predation and may well represent an evolutionary reversal. However, we cannot exclude the possibility that mining in this instance is a retained, ancestral habit until the host is analyzed for the presence or absence of compounds known to be effective in the shield defenses of *Oulema pumila*'s relatives.

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